

WHITMARSH
ON THE
MULBERRY TREE
AND
SILK WORM.

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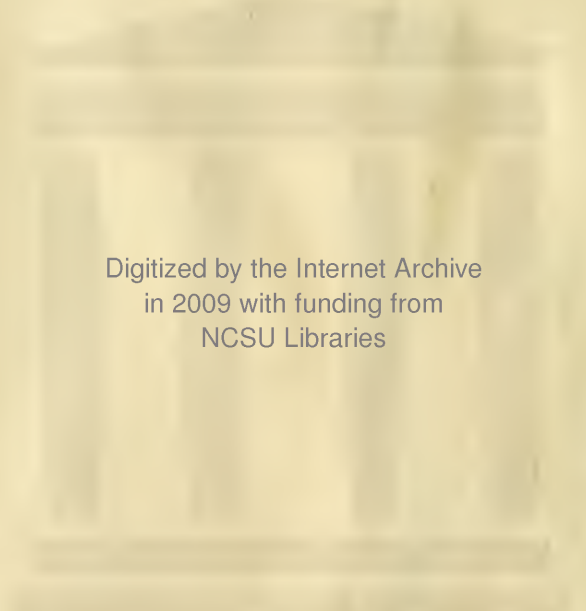












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MULBERRY TREE

AND SILK WORM.

EIGHT YEARS
EXPERIENCE AND OBSERVATION
IN THE CULTURE OF THE
MULBERRY TREE,
AND IN THE CARE OF THE
SILK WORM.

WITH REMARKS
ADAPTED TO THE AMERICAN SYSTEM OF PRO-
DUCING RAW SILK FOR EXPORTATION.

BY SAMUEL WHITMARSH.

Patience and Perseverance will convert the Mulberry Leaf
into SILK.—*Spanish Proverb.*

NORTHAMPTON:
PUBLISHED BY J. H. BUTLER.
FOR THE AUTHOR.

1839.

Entered according to act of Congress, in the year 1839, by
SAMUEL WHITMARSH, in the Clerk's office of the District
Court of Massachusetts District.

TO THE

Farmers of the United States,

AND THEIR CHILDREN :

To all my Countrymen, who are, or may be engaged in the interesting employment of raising Silk, I would respectfully dedicate this work, hoping that it will meet their wants, and promising that the profits of sale shall be devoted to the cause,

BY LAYING A FOUNDATION

FOR A

PATTERN FILATURE

FOR

INSTRUCTION IN REELING,

which shall be open to all.

SAMUEL WHITMARSH.

Northampton, Mass. Nov. 13, 1838.

C O N T E N T S.

	Page.
The selection of the mulberry tree,	15
Soil, - - - -	22
The culture and treatment of the mul- berry tree, - - -	35
Seed, - - - -	41
Eggs and Hatching, - - -	44
Feeding, - - - -	50
Cocoonry, - - - -	86
Reeling, - - - -	94
Produce of an acre, &c. - -	98
Do thunder storms affect the worms?	102
To landholders, - - -	105
To the overseers of the poor in towns and cities, - - -	108
State bounties, - - -	112
Manufacture of Silk, - -	117
Facts from Dandolo, - -	147

MULBERRY TREE

AND SILK WORM.

I HAVE been frequently solicited by the friends of the Silk cause to publish the result of my experience and observation, in a form suited to the silk-growing interest of this country :—most of the works already published being in a great measure compilations from foreign authors, which are made up of details, not at all applicable to what I shall term the American system ; for such must be the system by which we shall succeed in making raw silk one of the

great staples of our country ; and by which we shall induce our farmers to turn their attention to its extensive cultivation.

To farmers and planters we must in a great measure look for the production of the article. Much has been done and will continue to be done by individuals associated for the purpose ; but to the farmers and planters throughout our land I would particularly address myself and urge them to give their immediate and earnest attention to this all important subject ; to look into the matter thoroughly, and not only look but act. Be not alarmed by the frequent croakings about the high price of labor in this country and the impossi-

bility of raising silk, in competition with other countries ; it is too late in the day for any such arguments ; they vanish completely before the face of facts, which are better than all theories. The silk culture has gained too much headway to receive the least check to its speed by the fears and doubts of the timid. I urge you all to plant mulberries in the full assurance that they will be wanted. If you will not use them yourselves, you will leave your now worn out lands as a rich legacy to your children ; for you may be assured that silk must and will be raised from one extremity of our country to the other.

The attention of the people has been called to this subject repeatedly,

and from one cause and another it has been neglected, excepting in some parts of Connecticut and Massachusetts, and, before the revolution, in Georgia. But the time has come for general action, and I rejoice to say that the attention of the whole country is now alive to the subject, and if directed in the right course, will result in the complete establishment of the profitable culture of silk in the United States. *Congress* has taken the matter into serious consideration, and well it might, for it is of immense importance to the country : we have the soil, the climate and the population, to produce silk to any extent and of the best quality ; and I venture here to say, that

China and Bengal will before long feel the effects of the efforts now made, which will result in the production of silk to compete with them in the London market. I speak not at random ;—either or both of these countries may produce a lower priced article, but the *quality* of silk in all cases decides the question of preference, and in another place I will give the reasons for this opinion.

The cultivation of silk is in itself simple, and my object is now to treat a simple subject in a simple way, and to remove from it all the mystery of foreign authors. I would solicit the attention of farmers and their children. Old and young will find pleasure and profit in the culture ;

the whole process, from the egg to the reel, is very interesting and instructive, and I am quite certain they will be surprised at its simplicity. It is for them I write; to those who are better informed on the subject I need offer no apology for the plain and unadorned pages which I offer as all that is necessary to be known to constitute this a silk-producing country. Thousands are inquiring, what work on the subject is best? where shall we look for information? As I observed before, all the published works are translations of foreign authors, or compilations, and in my view not adapted to our country. I may not succeed any better, but I will try.

THE SELECTION OF THE MULBERRY TREE.

It is all important that we select the right sort of Mulberry tree, and provide a plenty of them ; and as the quality of the silk and the health of the worm depend much on the quality of the leaf and the soil on which it grows, I may trespass somewhat on the patience of my readers before I leave this chapter. It is a common error to suppose that the *size* of the leaf is every thing ; consequently almost every consideration is lost sight of in the pursuit of the

largest leaf ;—trees are manured and forced to their destruction. A large leaf is certainly desirable if it be of a dry nature, containing more of the resinous substance, and less of water than many of the larger leaf kinds, as the black, red, &c. All the varieties of the white mulberry are better than these.

Great allowance should be made for the more luxuriant growth of the mulberry in this country, it being much greater than in France or Italy. We should adapt the tree to the soil ; the more luxuriant kinds should be planted on the poorer soils, while those of a slower growth may occupy richer lands. In the South of France and Italy, where the mulberry is ex-

tensively cultivated for silk, plantations are made with great care, principally of grafted mulberry trees, trimmed to a head as standards and carefully pruned and as carefully handled when the leaves are picked. All this is very well for a country where the growth of wood in a season is but small, where land cannot be exclusively devoted to the mulberry, and where also the labor of gathering leaves by the help of ladders can be sustained. This cannot be done in this country in competition with the cheap labor of Europe, at least not extensively.

Silk has heretofore been raised from standard trees in this country ; but the superior adaptation of our

soil and climate to the growth of the mulberry and silk worm, the cheapness of land, the superior intelligence and activity of our farmers—themselves the owners of the soil—all tend to mark this country as destined to become one of the first, if not the first, for the production of raw silk. China may excel in quantity, but not in quality. *Neither France or Italy* can produce silk so cheap as the United States. China and Bengal produce the cheapest silk, but it cannot be delivered in this country at so low a price as it can be raised for here. If we pursue a system adapted to our climate and state of society, we should not look to foreigners for aid, who are

generally wedded to their own systems (which for them may be well enough ;) but pursue a course which nature points out to us.

Silk may be made from a mulberry which is indigenous to our country, but the quality will not compare with that made from the finer kinds, nor will the same success attend the growth of the worm. The black and red mulberry contain too much water in the leaf, particularly under cultivation. The silk made from them is strong and well adapted to *Sewing Silk*, but not for the finer articles, for which the main crop of silk is wanted.

A very common error prevails of planting trees too close or in

hedges, as they are called. No kind of mulberry should be planted closer than four feet (I prefer eight feet between the rows and four feet between the trees) if good silk and healthy worms are desired ; and if you do not wish to gather twice the quantity of leaf which ought to produce a pound of silk. Every plant should have the *sun* and *air* to mature its leaves ; and it should be our aim to perfect the worm and bring it to winding its cocoon with as little bulk of leaf as possible. As the resinous substance in the leaf is that which fills the silk bags of the worm, the smaller the quantity of leaf required to perfect the worm, the less will be the danger of a superabun-

dance of water in the leaf—a cause of disease in the worm. Any one who will try the experiment with closely planted trees, or trees in a rich soil, and with those of a dry gravelly soil with more space, will find the result in favor of the apparently poorer growth.

S O I L.

THE soil most suitable for the production of good silk is a gravelly loam on a sub-soil of gravel and sand. Stony lands, hills and elevated plains are suitable, or any warm *dry* soil. A rich loam is not so good. Clay is not suitable; trees will grow in it well enough, but it will produce a watery leaf.

There are millions of acres lying in waste, in Virginia and the Carolinas, which would produce rich crops of silk and clothe the now desolate commons with the most beautiful fo-

liage; and what is better, help to clothe the poor, feed the hungry, and raise the drooping spirits of thousands who now find it difficult to sustain themselves, and who would, I am sure, gladly avail themselves of any opportunity of obtaining profitable and healthy employment.

The raising of silk is as interesting as it is profitable. It is not laborious or difficult, nor does it require large capital. It is happily within the means of the most humble, and offers to all who will undertake it a rich return.

I would here suggest to landholders in the vicinity of towns, that by planting their light lands with mulberry trees they would not only in-

sure to themselves a large and increasing income, but enjoy the satisfaction of giving a pleasant and healthy employment to hundreds of families who may not be in a situation to provide it for themselves. Light land planted with the mulberry will yield a large profit by the sale of the leaves only, or by having them fed on shares.

Every farm has more or less of black vegetable matter collected in hollows and swamps, usually called muck, which is the best of manure for the mulberry, causing it to flourish on very light and sandy soils. The muck should be thrown up in the fall to freeze and sweeten, as the gardeners say; before planting the

trees, put it into the furrows or holes, and the trees, once started in it, will continue to flourish for many years. No mulberry tree should be manured with fresh barn manure; it is rank poison to them, and is one great cause of their being winter-killed. The well rotted vegetable matter above mentioned is the best and most durable manure. It causes a thrifty natural growth. A little ashes or lime may improve it in some cases. Old woolen rags, bones, fish, and all animal substances, are useful; but the muck, which is within reach of almost every one, is the cheapest and on a large scale the main thing to be depended on.

Mulberries, when planted out, should be kept clear of grass and weeds, and the ground loose about them. They delight in a mellow soil, and when once well established in a healthy state will continue to improve for twenty-five years, if well used. We are told by some, that “the more you pick them the faster they will grow,” the fallacy of which must appear to every one who will for a moment consider the nature of the operation of stripping a tree of its foliage once or more every season.

We are also told that several crops may be fed from the same trees in a season ;—this you may do if you do not regard the durability of the tree.

Once a year is quite often enough to strip them of leaves or branches, (feeding with branches has many advantages which I shall mention in another place.) Several crops of worms may be fed in a season, but not from the same trees. Trees enough should be provided to make a second picking unnecessary. We have land in abundance; and the same building may accommodate a succession of crops fed from a succession of acres.

I would not have my readers place implicit confidence in what I say on the subject, as I may be mistaken. But let any one who doubts it try the experiment;—set apart a few trees, no matter of what sort, and

pluck the leaves as many times in a season as you please; it is *possible* that the leaves will diminish in size and quantity by the operation, and it is also *possible*, that after a year or two there will be no leaves at all, that the trees will perish in summer or winter—most likely the latter. It should be considered, that what is called a hardy tree is not merely one that will endure cold winters, but the clipping, picking, and hard usage which they will be likely to receive according to our mode of treatment when they come to be fed from.

In making a plantation for the culture of silk, we must suppose it of course to be a permanent one which shall be a continued source of profit,

the profit increasing with the age and growth of the tree, if well used ; and nothing is better repaid than good care and cultivation for the mulberry. We shall need much less care than the cultivators of Europe, as the mulberry thrives much better in this country and makes a much more luxuriant growth,—so much so indeed, that I have seen intelligent men, who had extensive acquaintance and experience with the mulberry in France and Italy, quite at a loss amidst our fields, to recognize their old acquaintance—varieties which they have long cultivated at home, here quite changed in appearance. They could scarcely believe

the fact, when shown a year's growth of the mulberry in this country.

In consideration of the vigorous growth, we should give more space for our standard trees or stools; as by our system of cutting them down every year they will spread over a large space. Eight feet by four is quite near enough for the vigorously growing kinds. They will meet in a few years, and when leaves are deprived of *sun* and *air*, they are of little use to the silk grower.

The mulberry delights in the hottest sunshine,—never too hot, if moisture is seasonably supplied. Our bright sunshine and frequent showers, cause an almost too luxuriant

growth of the mulberry, in some cases detrimental to the worms.

The leaves are undoubtedly improved by the age of the tree, having less of the rough, harsh taste and feeling, that are common to the plants of younger growth. It is found in Europe that the worms succeed best when brought out simultaneously with the leaf. They are generally hatched much later in this country, and the general character of vegetation differs so materially from that of the silk districts of France and Italy, and withal so extensive is our country and so various its climate, that I can give no better rule than for the *North* to aim at the most genial and steady heat, and for the *South* to en-

deavor to finish the crop before the hottest season commences. Excessive heat is more to be dreaded than cold. Cold only retards the worms; excessive heat destroys them. An equal temperature of about 72 degrees of Farenheit is most to be desired;—but I am wandering from the subject of soil.

This, as I have before observed, must be warm, gravelly, or sandy. It is often said, that “the poorest land is the best for the mulberry.” It is not so. It may with truth be said that the light lands of a farm—too light for profit in other crops—may be most advantageously planted with the mulberry, and in a few years, by proper treatment, be made

more profitable than richer lands, planted with other crops. I have seen many acres set out with mulberry trees, the soil so poor that blackberry briars would starve ; whilst mulberry trees from four to eight feet high with full heads were set in barren sand ; and because they would not *begin* to grow, “ the silk business was all moonshine.” Now, had the holes been filled with *muck*, and *the heads of the trees cut off*—poor as the soil was, they would have made a good growth, and in a few years, when well rooted, produced a good crop of silk.

Lands that are considered worn out for corn or cotton may thus be made productive, and of the best

silk. The mulberry strikes its root deep, and when once well established, will do better on light lands than any other tree. Lands which will grow twenty bushels of corn to the acre, manured, are quite strong enough for good silk, if on a gravelly or sandy bottom. Such lands, by the application of ashes, lime, mud or muck, or compost of all kinds, will produce vigorous trees with the sweetest foliage, and silk of the best quality, and much more than lower richer lands. It is the *dry* nature of the leaf on such lands that makes the silk so superior.

THE CULTURE AND TREATMENT OF THE MULBERRY TREE.

THE mulberry tree is of course but little known in this country, so recent is the awakened interest in its culture. It will prove to us a source of great wealth, and it should receive the attention that it merits. It will add another valuable staple to our agriculture, the true source of wealth to any country,—a staple that will conduce more to the happiness and comfort of our *whole country* than any

other. There is no other that has not its peculiar locality, while the mulberry and silk worm will flourish from the extreme north to the southern borders of our country. If there is any advantage, in one part of the country over another, it is in favor of the north; but all parts of it *may* participate in its benefits, and I hope *will* do so.

To propagate by cuttings and layers seems best adapted to the go-ahead propensities of our countrymen. In Europe grafting and budding are much resorted to, even in hedges. It is not desirable for us, nor is it practicable on an extensive scale.

No kind of mulberry under cultivation can be produced from seed.*

* By the above assertion, I mean that if we wish to cultivate or propagate any particular kind of mulberry, we must not expect to do it by seeds. We may indeed select many valuable kinds from seedlings. Some produce fewer varieties than others—but a *particular mulberry*, like any other fruit tree, must be continued by graftings or cuttings. I have trees four years old which I raised from fruit gathered by myself from the Multicaulis trees in my own grounds. Of four trees no two are alike, and neither of them like the parent tree. All have lobed leaves. Two of them have leaves no larger than the smallest white mulberry. This could not be the result of mixture from other trees, as the multicaulis fruit was fairly set, in fact well filled, *before the white mulberry was in blossom*. This I particularly observed at the

This should be generally understood as much disappointment would be thereby avoided. Many persons purchase seed expecting it to produce trees exactly like the parent. But they will see varieties without number, and if they would increase any *one* among them, it must be by grafting, budding, or cuttings. *Wood*

time; although it was said by the knowing ones, and is believed to this day, that "it must be a mixture with the white." There could be no mistake in the case, as I planted the fruit in *two* minutes from the tree, and kept the plants in a flower pot till the second year, and then planted them with my own hands where they now stand. I have been thus particular as there are many theories upon the subject of multicaulis and other seeds.

for cuttings should be kept in sand through the winter. When the buds swell in the spring, cut them into one or two bud cuttings as you may think best. Cut them half an inch below the bud. Make the ground mellow and rich. Place the cuttings under the soil, about two or three inches, according to the situation. When the sprout appears through the ground, nearly cover it with earth; do the same when it is grown an inch or two more; and you will not lose one in fifty. Keep them clear of weeds and the ground loose;—hoe often, weeds or no weeds; and you will have no need of the watering pot. I have known weeds,

left to shade the cuttings, to exhaust all the moisture from the soil and prevent the dews from penetrating to the roots.

S E E D.

MULBERRY seed should be soaked twenty-four hours in warm water and rolled in dry wood ashes. Sow it in rich ground—cover it *one quarter of an inch* and *press the ground* by a board—or, if on a large scale, the roller. Keep the weeds from the plants, and after one year transplant them where they are to grow. Cut them off two buds above the ground in all cases when shrubs or stools are wanted. The tops may be used for cuttings, which make handsomer trees than layers, and form much

larger roots. Cuttings are quite sure, if treated as I have directed. Single eyes, or cuttings of two eyes, make the best trees with fine large roots and numerous branches.

Mulberry trees are often buried too early in the fall, before the sap is still, and before the ground is cold to the proper depth. In such a case, they become heated and spoiled. Let them remain till there is danger of the ground freezing too hard to dig. Make a trench from two to four feet deep in a dry soil, put a layer of trees a foot or two thick, and then throw on the soil, filling well the space between the roots and branches. Raise the earth to a point to turn off the water. *Plant*

them as you take them out. They must not be exposed long to the air after being taken out. Cuttings often fail in consequence.

EGGS AND HATCHING.

IT is highly important that the eggs should be of the best quality and that they should have been carefully kept. Many of the diseases of the worms may be traced to the egg and the coming forth from it. Eggs are often kept in damp places, and contract mould. If they hatch they are not so healthy as when kept *cold and dry*.

Foreign authors tell us we must not let the eggs freeze, and that this will certainly kill them. There can be certainly no advantage in letting

them freeze, but it is well to know whether accidental freezing will destroy them, in order that we may govern ourselves accordingly. To test the matter, in the summer of 1832 I put a miller on the shutter of my green-house, on the *north side*. She deposited her eggs, a full complement; they remained on that shutter through the summer and winter, *exposed to all the storms*. The shutter was taken down every day and was frequently covered with snow and ice. The thermometer hanging on the same shutter, stood several mornings at 18 and 22 degrees below zero, Farenheit, yet every egg, save six, which were crushed, hatched with the first buds of the

white mulberry. The worms were healthy and vigorous and made fine cocoons. I should say that the millions of eggs, which have been lost within a year or two, have been lost from the dampness and confined air of the ice-house or cellar. When brought forth to hatch, they have been brought suddenly from the ice to 75 or 80 degrees of heat. The result was that the worms died in the egg or soon after leaving it; or perhaps that they lingered till the third change.

The eggs should be brought gradually to the warm air. We have only to expose the paper or cloth*

* I never could imagine why the French re-

gradually to the air of the hatching room, and about the sixth or seventh day the black heads of the worms may be seen through the shell. Tender leaves should be placed round the edge of the paper to prevent the worms going over. They will collect on the leaves, and each day's hatching will be finished about

quire us "to scrape the eggs from the papers—wash them in *wine*," and make the poor little fellows earn their first meal by climbing through small holes pierced in paper. I have seen yankee recommendations of the same course. What possible reasons they have for it I know not, but I do know that they hatch better when left on the papers. The worm has something by which to help itself in coming out, in consequence of the egg being glued to the cloth.

10 o'clock, A. M. They come forth from sunrise to about that time each morning. *Keep the worms of each day's hatching by themselves*; the importance of doing this you will realize when feeding, as they will go through with their changes, about the same time, if equally fed. Should worms of the first day become mixed with those of the third day, it will be a source of trouble and annoyance throughout the whole course. Try it.

I have raised worms in the open air till nearly grown, but they were taken by birds. The eggs were pinned upon the leaves. They hatched, and escaped all the storms of thunder and rain, till the third change, when the birds destroyed

them. It can be no object to raise worms in the open air, (I have no doubt they can be so raised,) as the silk will not be fine. Good silk is not raised in the open air in any country. A coarse article is thus raised in China;—such as the slate pongees are made of. But all the fine silk is raised under shelter.

F E E D I N G.



WE have now come to an important part of our subject. And I would here remark that although the raising of silk is perfectly simple, a thing which any child may do, yet our good or ill success, our profit or loss, will depend on the attention we give to this wonderful insect, during its short life. The period of its existence as a worm, may be from twenty to fifty days, according to our own diligence or neglect. It will be found that the quantity of silk will vary in like proportion.

Experience teaches us, that *frequent* feeding is the best. If we leave them four or five hours, and then feed them profusely, we endanger their lives by overfeeding. They will do well if fed four times in twenty-four hours, but they will do better with eight or ten meals.

When a sufficient number are fed to make it an object, it will be well *to feed them during the night*. A change of hands from day to night would make the work easy. Time and silk would be gained by it. The best cocoons I ever saw were raised this year, (1838) in *eighteen days*, from what is called the six weeks worm. The worms were attended *day and night*. The shortest day-

fed ones were fed from twenty-four to thirty days, and the cocoons were not so good. The Chinese produce nearly twice as much silk from an ounce of eggs as the French or Italians, *mainly by night feeding and constant attendance.*

Cocoons may be raised with but very little care or attention. I write for those who I hope will make a business of raising them, and if this business is worth pursuing at all, it deserves the greatest attention. It is the neglectful who may tell you that you cannot raise silk in this country. Perhaps they have tried a few thousand worms, and in consequence of neglect have lost them at the moment of moulting.

A sufficient supply of leaves for two or three days' consumption should be on hand for the last ages of the worm. Leaves will keep a week in a *dark* cool cellar, with a brick floor, if turned occasionally to prevent heating. Leaves that have remained for several days in the dark cellar, must be spread in the light about an hour before feeding.

I would not recommend the use of wet leaves, although I have used them occasionally, and perceived no bad effect from it. Much depends on the leaf we use, and on the wetness or dryness of the season. It is a point which all can decide for themselves, although one season will not determine it. I con-

sider it unsafe as a general practice, and should suppose that the silk would be affected by it as it is by leaves from a wet soil. Leaves will heat if pressed closely in bags or baskets more than an hour or two. This must be avoided, as heated or fermented leaves will destroy the worms.

The mulberry leaf is composed of five substances—the fibrous substance, coloring matter, water, saccharine, and the resinous substance. The three first, excepting that which in part composes the body of the worm, cannot be said to be nutritive. The saccharine matter nourishes the insect. The *resinous substance* is that which fills the silk vessels.

The mulberry grown on moist rich soils contains too much water in proportion to the *resinous* substance. Consequently the worm must consume a larger quantity of leaf to fill the silk vessels, and is thus subjected to disease and death.

A *superabundance of moisture* in any way is *detrimental to the worm*, and to the quality of the silk. It is for this reason that silk cannot be raised in England. The soil and climate are too humid for the tree, and consequently for the worm. They have not the bright sunshine that suits the mulberry, and renders it productive of silk. Hence England will be our best *market* for raw silk and must remain so.

The worm evaporates an immense quantity of moisture in the driest climate, and requires not only dry food, but a dry atmosphere, and a free circulation of air.

Silk worms breathe by several apertures near the feet, and must not be crowded on the shelves, as respiration will be difficult and diseases occur. Stagnant damp air is most to be avoided in feeding worms. It may be remedied by a simple hot air furnace in the cellar. This will create a circulation of air while it dissipates the moisture. The only use of a furnace is in case of protracted rains, when the cocoonry must necessarily be closed and the air become damp and stagnant. A mode-

rate fire in such cases (in a furnace, not a stove) revives the worms and improves their appetite. It is particularly desirable, if a storm occurs while they are *moulting*, which is the most critical time with them. With a plenty of good dry food and fresh air, with the wind from the west and northwest, the worms will be sure to thrive.

It is to the dry north and northwest winds, and the abundance of electricity in the air, that we may in a great measure attribute the singular success of the silk worm in this country, without artificial heat, and the superior quantity as well as quality of the silk. It is a fact, that from a given quantity of *cocoons*, *one third*

more silk may be reeled than in France or Italy ;—a difference sufficient in itself to counterbalance the cheapness of labor in those countries. The *loss of worms* is not *one half* as much as in those countries.

The culture of silk then is for us a simple matter, too much so you may think to write so much about. But simple as it is, our success will depend on the observance of a few simple rules, which I shall in a plain way give in their proper places. Let no one despise them because they are simple. There is nothing mysterious about the matter. Although men of high reputation for science, in Europe, have devoted much time to scientific experiments

and have written volumes upon the subject,—still, as it regards the *American System*, their writings will benefit us but little.

Our system must vary materially from that of Europe or China. Our country is extensive, its soil and climate are various. Its people are too active and enterprising to devote their time and attention to the petty details of foreign authors; nor is this necessary.

I do not say that these details may not be useful for other countries, but that they are not necessary for us. And if by these few pages I shall be able so far to remove the mystery which has been for centuries designedly thrown over the culture of silk,

as to induce our farmers generally to engage earnestly in the business, I shall have accomplished the purpose for which I have consented thus to come before the public, in the face of volumes, written by scientific men,—men who are deserving of all praise for their exertions and for the satisfactory results of their experiments.

These pages are merely offered as the result of eight years experience, and close study and observation of the silk worm and mulberry, in this country, attending the production not only of raw silk, but the various articles of manufacture. This experience has been confirmed by a personal inspection of the most celebra-

ted silk districts of France and Italy. I must beg pardon of my readers while I boast of being clothed in part with the richest silks, the product of *my own soil and looms*.

It is to this production of *raw silk for exportation* that I would call the attention of my countrymen. There is not, in my view of the case, *one single obstacle in the way of complete success*, and I now say, if our farmers are true to their own interests, the amount of raw silk for exportation, will be in a few years, equal in value to the present cotton crop of the United States. The field is open to all, from Maine to Mexico. We are often met by the bugbear of the "cheap labor of other countries,"

without considering the difference in climate, and in the state of society, and without regard to *facts*, which after all are the best arguments.

It is an ascertained *fact* that a merchantable article of raw silk may be produced for market, at a cost not exceeding one dollar and fifty cents per pound, and that the silk of this country is superior to most, and equal to any, in the world.

I speak from experience in regard to the superior quality of American silk, and that experience is confirmed by the opinions of the first silk manufacturers of France and England. I have used the silks of France, Italy, Turkey, China and Bengal, in the progress of manufac-

tures, and give the American the preference by twenty-five per cent.

We have only to produce a sufficient quantity for trial in the London market, to prove that we shall compete successfully with countries where men live on a few cents' worth of rice per day.

It will certainly be cause for rejoicing, when our free and happy farmers can compete with the degraded and miserable population of other countries, and that too from lands already exhausted by the culture of the vilest of weeds—Tobacco.

In connection with raising silk for exportation, I would here speak of the great importance of a *uniformity of reeling*, both as it regards the

quality of the work, and the length of the skein. This matter is regulated by law in Italy,—particularly in Piedmont, which is one cause for the superior reputation of that silk in the market.

Silk, to be fitted for the finest fabrics, should be reeled on a machine, simple in itself, but of *great accuracy of proportion* and workmanship. With such an instrument, if we make a good beginning, there will be no difficulty. But if we allow ourselves to be attracted by the numerous inventions that are daily offered for the purpose, we shall be led into great confusion, and occasion in the end much loss.

I trust that the inventors of ma-

chines for reeling will do me the justice to believe that I am actuated by no other motive than the good of the cause and the country in the remarks I may make ; and I think they *will*, if they do not now, agree with me in saying, that we can do no better, than adopt the best constructed reel of Italy for our model, particularly for raw silk.

I would have it understood here and elsewhere that my remarks relate to the production of a merchantable article of *raw silk*. Of the domestic manufacture of sewings on any machine I have nothing to say, other than that to spin the cocoons, without selection, into sewings, is the greatest extravagance, as the raw

material is worth more than the manufactured. But in regard to the reeling of silk I am sure I cannot be too urgent in insisting upon a *uniformity of style* from one end of the Union to the other.

When American *raw silk* is offered in Europe, let it be understood that it will fit the machinery used for the Italian silk, and that a bale of a certain number may be depended on. None but manufacturers can appreciate the evils of five or six qualities of silk in the same bale and as many sizes in the skeins. The *reeling* is the *foundation* of the whole business, and on its good or ill performance, will depend the value of the silk.

Of such importance do I consider it, that I shall propose in another place, or at another time, a plan for a filature, open to all who would learn it. The art is simple and may be acquired by a few lessons. But *practice* makes perfect, and when the first principles are understood, time and practice only, will perfect it.

It is, and ever will be, in vain to talk of "the inventive genius of Americans, doing away with the difficulty of reeling." This we are told is already accomplished, and we are told that still greater improvements may be expected.

Now, the only difficulty that exists, or ever has existed in reeling is to keep up the uniform size of the

threads; which difficulty arises from the fact, that the silk worm makes a difference of *full one half* in the size of the thread, from the commencement to the finishing of the cocoon.

Unless we can teach the worm a new lesson, we may rest assured there will be no machine to reel silk, other than the simple reel, and the nimble fingers, of the most beautiful machines in the world,—our own fair country-women.

The reel itself is but the common cross band reel. The *traverse* bar is the principal thing, which is designed to imitate the motion of the worm in winding the cocoon. There are various ways of obtaining that motion, but experience has proved that

the proportions and principle of the best Italian reel, should be our model.

The reel of Italy is all I would imitate in the silk culture of that country. I shall not presume so far to libel the good sense and intelligence of my readers, as to give the numerous details which regulate every movement of French and Italian culturists in every age and change of the worm, and on which their authors insist, but which experience has proved to be useless to us. Errors have been committed, and useless expense has been incurred, by following directions which were intended for quite a different world

from ours, so far as the culture of silk is concerned.

As the mulberry leaf is the *foundation*, so will the well reeled, beautiful *bale* of *raw silk* be the cap sheaf, of our labors. And I trust I may be borne with, if I should be thought to dwell too long on both, or if in these pages, I often repeat the same things in different connections. I shall trust to a few simple directions, given to those who are ever ready to comprehend them, and able to fill up the outlines.

To return then, to the importance of good reeling, I will here mention the evils that attend bad reeling, and that exist in most of the foreign

silk, particularly China, Bengal, and Broussa, and some Italian.

One *great evil* is, that the threads are permitted to run nearly out before other ends are joined, so that in an ordinary skein, there are some threads of from *three* to *five* and others of from *twenty* to *twenty-five* cocoons, which it is impossible to separate, and of which it is impossible to manufacture a good article. Consequently the silk commands but a low price, and perhaps, would not sell at all, if better could be had. It must be evident then, our labor is thrown away, if we allow the silk to be carelessly reeled, as the *best cocoons* are on a level with the poorest, if thus thrown together.

I would not make the reeling difficult. It is not so—far from it. But I would represent the evils of bad reeling, that we may avoid them. Let us take a high stand at the outset, and aim to equal, if not excel, the best. If we come short, I shall be disappointed.

Another evil to be avoided is the throwing on of ends or rather not joining them in reeling, which makes the spooling troublesome and liable to waste.

Good bright, smooth silk, is known by looking down the skein *against the light*. Every imperfection will be seen. And if a roughness appears in the raw silk, it will be more apparent when the gum is boiled out.

The roughness is caused in some cases by too hot water in reeling, but oftener by the soil on which the tree is grown. A rich moist soil will produce it, or a too luxuriant growth on any soil. I have seen silk from a moist soil, which has baffled all the art of the dyer. No good color could be fixed on it; nothing but a dull brown. The silk had the appearance of cotton. My readers will here perceive the importance of a dry soil for silk, and a dry leaf,—dry in its nature and free from external moisture.

After much wandering, we will return to the feeding. We are directed to “*chop* the leaves small for the worms.” For this I can see no

good reason, but rather many against it. I do not practice it myself, nor do I recommend it. On this point all can decide for themselves. My worms chop the leaves quite fast enough, and I think do better on entire leaves or twigs.

When the mulberry branches cease to be worth *six cents an inch*, I propose to feed with branches, as they come from the tree. I am persuaded that this practice will be generally adopted in this country. It has many advantages, some of which I will enumerate.

In the first place the foliage may be gathered in much less time. It will keep better till consumed. The same saving of time is gained in feed-

ing, and much more in cleaning off the frames. The worms mount the twigs while feeding, and remain afterward, having more advantage of the air and more space than on a flat surface. The leaf will be entirely consumed, leaving nothing but dry branches to remove. The ordure of the worms will fall through to the shelf, themselves entirely free from it on the branches. They will have a better chance to be equally fed; and if this be not attended to, the ill fed ones will lag behind. But the greatest advantage of all is, that they need not be removed from the frame from the time they are put on to it till they mount to wind the cocoon. This will be a vast saving of labor,

and prevent the handling of the worms, which is always to be avoided. As the branches are laid on, they should be laid first crosswise and then lengthwise with the frame, making thus a sort of net-work, which can be easily separated in layers when you clean them off. The worms will be more healthy, particularly in moulting time, as in the usual way of feeding with leaves, they retire *under the litter*, and remain there till they change, where they must breathe a bad air, and in many cases be smothered by the accumulation of matter.

I may as well mention here the system of cutting the branches. Supposing your trees to stand ten or

twelve feet high at the feeding time—cut them within three or four feet of the ground, making clean work as you go, cutting the branches within two or three inches of the body.

The tree thus trimmed must be left to itself the remainder of the season. It will produce a new head to be taken off the next spring or feeding time. They will be thus kept within reach, and always handsomer and better than when stripped of their leaves. If cut too low, the lower leaves are useless, from sand and dirt thrown up by showers. The branches when cut should be laid in the cellar, where if wet they will soon dry. After being fed from

they may be planted in furrows, and will, many of them, grow.

I have before expressed my views on frequent feeding and on the advantage of feeding in the night. I shall conclude all I have to say on this subject in a few words. Feed the worms regularly, frequently, and as abundantly as circumstances require. Let them always have as much as they will eat with a *good appetite*, always observing that when the time of moulting arrives, they will *cease to eat* and retire among the branches or leaves. *They must then be left quiet* till they revive, which will be in about twenty-four hours. When well aroused, clean them off and feed as before, and con-

tinue to do so through every age. But for the last week make your calculations for leaves, as for several yokes of oxen, as more will be required than in the whole previous ages. And now for a week or ten days you must be active, for your own labor is nearly over, and that of the worms about to commence. You will soon see them looking about for a room to retire in, as they do not like to be seen making their cocoons in public. You will therefore provide for them when you see them raise their heads from the fresh leaves and move about.

The silk worm has a very useful peculiarity, that it *never wanders from the shelf on which it is first*

placed, except in case of disease, or when ready to moult. It never moves but to its food. Perhaps during its life it does not move over three feet of space. What could we do with them, did they wander about like other caterpillars?—But we left them looking for a frame, or bundle of clean straw, which is quite as good, and more convenient; and although I shall show in a plate how to arrange them, I will say here, that good clean rye or wheat straw, with the heads cut off, and tied in bundles as big as your arm, placed along the shelves, reaching from the top to the bottom, will be well filled with cocoons, which will be easily gathered.

I have seen many kinds of mounting frames recommended, one of which is made by boring holes in a plank, with a two inch auger. But I think I see you with one thousand bushels of cocoons to gather, *punching them out one by one* with your finger, and I think you will get through about the time of feeding next year; perhaps some of them will be out of shape, and flat cocoons will not reel well. Every thing in the way of mounting frames, should be calculated for *facility* in *gathering the cocoons*. More time will be required to gather, than to raise them according to some plans. If you must have a frame, there can be none better

than one I have described in the *cocoonry*.

As we left the worms going up into the straw, we will leave them there about eight days after they have finished the cocoon, when they may be taken down and reeled immediately, or put in the sun to stifle the chrysalis. Two or three days exposure to the sun will be effectual, and dispel the moisture; which is essential, as they will heat and spoil if put away damp.

There are various means of stifling the chrysalis, but the sun is the best, and is happily free for the use of all, as it is the *safest*. In unskilful hands the cocoons may be, and often are,

spoiled by too much heat. I could mention other ways of doing it, but I will not. The sun's warmth is good enough and I shall not attempt to suggest any thing better.

Before putting the cocoons in the sun, you should gather a sufficient number of the best for eggs. Two hundred and fifty will produce one ounce of eggs, or forty thousand. We cannot distinguish with exactness the male from the female in the cocoon. That pointed at one end and drawn in at the middle contains the male ;—that which contains the female is nearly alike at both ends. Lay them away where no mice can come. *Mice destroy from the egg to the miller*, cocoons and raw silk not

excepted. In about fourteen days the millers will come forth and couple. They should not be left together more than twelve hours. Separate them gently, and after the females have discharged the brownish substance, put them on a clean white paper or cloth in a dark place. After laying the eggs, the millers die, and thus ends this wonderful insect,—ends but to begin again its course another year.

Is it not curious and wonderful, that the worm, after its feeding and changes should wind itself into its air-tight tomb, and then undergo a complete change and come out white and pure, and after providing for the continuation of its species, should

die, *without taking food* from the day of commencing the cocoon ?

You have followed me thus far, with some skipping, and I have said nothing of the manner of cleaning the frames. They certainly should not have been left all this time without cleaning ;—so if you will just lift up the top layer of branches, or leaves, where the worms are, I will pull out the remainder and put under a clean newspaper, and you will now let them down again without disturbing them. The next shelf you must have some other person to help you clean, as I have a cocoon-ry yet to build, and some other matters to attend to.

C O C O O N R Y.

As we have been some time feeding worms, we will take a view of the buildings, previous to reeling our cocoons, and although any vacant room will answer a good purpose, yet I hope some of my readers will need extensive accommodations for worms. A cheap rough building will answer, but it should be convenient and planned with reference to *ventilation*.

I have one two hundred feet long by twenty-six feet wide and two stories high, which will accommodate

two millions of worms. It is set on brick pillars of three feet high, except the ends, which have cellars for the leaves, and a furnace. In the floor under each frame, a board is sawed out, eighteen inches by twelve, with a strip of board for a handle. These are easily removed. The use of them will be apparent before we get through. The point of the roof is raised about eight inches,—making a projection of three feet, and has the appearance of a double roof. Lids are hung with leather hinges every three feet, to be opened and shut by cords. The holes in the floor being open, and those in the roof—a free circulation goes on, aided by another row of

holes about midway, or even with the second floor. These are made by pressing off a board about three inches from the side. Let this space be closed with lids, which by means of buttons underneath, may be raised in a moment.

I have said that it was two stories—it is so, as far as two rows of windows make it so. The rafters are laid across for a second floor, but they are only boarded, six feet wide in the center, and three feet at the sides, making a walk, or gallery for coming at the frames, *which must never touch the side walls*. The object of this arrangement is to have as much room as possible under one roof. A lower room is apt to contract damp-

ness. Uprights are made of slit-work, three inches square, and as the frames are three by six feet, the up-rights are six by six feet apart, with slats nailed across, and accommodate two rows of frames drawing out each way.

I have used netting, and have all my frames fitted with it; *but I do not now use it.** The same frame, with millinet or grass cloth, drawn on at the corners, is better, and may

* Netting is convenient when the worms are to be thinned out or spread on clean frames. Lay a netted frame over the worms, on which spread leaves. A sufficient number will ascend to remove to another place. The net should lay flat on the shelf. Beyond the above pur-

be taken off and washed and put away for another season. Frames covered with cloth are lighter than boards and quite as cheap, and the open spaces of the cloth admit the air to the litter beneath and prevent its gathering dampness.

I have mounting frames, but were I to erect another cocoonry, I would use straw in preference. The frames are three feet long, one and a half wide, made of inch stuff. Two

pose, netting is of no use whatever. As the worms *will not all* go up when you would change them, you must gather the remainder by hand, as you would blackberries. They should never be touched by the hand if it can be avoided.

of them are joined together, as the leaves of a book, leaving a space of one inch between them for the cocoon. The outside of the frames are covered by common lath, with spaces of half an inch. These are placed upright across the frame, about four for each frame. A large cocoonry requires a large number, instead of which straw may well be used.

In so large a building there should be a partition across the center, making the rooms one hundred feet long. A room twenty-six by twenty feet should be finished off under the roof for a hatching room, for the first week's feeding, and for millers,

and should be lathed and plastered. In the cellar under each end is a furnace for hot air, made by enclosing a common box stove in a brick chamber, six inches larger than the stove, with spaces at the bottom for the admission of cold air, which is admitted into the room above by a hole in the floor of two feet square. The object of this furnace is explained in another place. A thermometer will be useful to indicate the changes. A plate of common salt will detect *dampness*, and one of chloride of lime will correct bad air or smell in the cocoonry. If properly cleaned it will smell of nothing but the wholesome mulberry leaves. You must

not mention *Tobacco* in the presence of silk worms. In regard to this drug they show good taste ; *they had rather die than smell it.*

R E E L I N G.

I HAVE in another place expressed my views of the importance of perfect reeling, and I have said that it must be acquired by *practice*. A few general directions are all that will be necessary here. I hope at a future day to point out a method, by which persons from all parts of the country may be instructed practically and be qualified to teach others.

As this little work is calculated for general information on the subject of silk culture, it will be expected that some directions will be given. So

far as our own manufactures are concerned, silk is now sufficiently well reeled ; and I trust it will be suitable for exportation, with a little more experience and practice.

The water for reeling must be *soft* and free from sand or dirt. The degree of heat must be graduated by the state of the cocoons ; no definite rule for it can be given. As a general rule, the water should not boil, but be kept nearly at the boiling point. If the water is too hot, the silk will come off in burrs, and it must be cooled ; if too cold, the cocoons fly up to the guide wires.

Press the cocoons *gently* under the water with a bunch of twigs or broom corn ; the ends will adhere to

it. After collecting a sufficient number, pull off the coarse silk till it runs clear. When another thread is collected in the same way, cross them eight or ten times, before going to the reel. You will then pass the threads through the guide wires to the reel, attaching them in two places for two skeins. Turn the reel *steadily* and rapidly. Join the ends constantly as some run out or break. Keep the water clean by taking out the skins with a skimmer. The water must be changed twice a day. The silk should be left on the reel to dry rapidly.

The most convenient way to heat the water is by steam. Make the basin double, one within the other,

leaving a space of an inch for the steam to pass in at one end and out at the other. With a stop-cock in the pipe, you may have full command of the heat and regulate it at pleasure. A small boiler heated by a lamp, would answer every purpose for domestic use ; it is certainly to be preferred to a furnace of charcoal.

PRODUCE OF AN ACRE, &c.



I HAVE said nothing of the profits of the silk culture, or rather have made no exact calculations of the produce of an acre of land.

An acre of land may be rich or poor, in a climate of short summers or long ones, of slow growth or rapid, so that no exact calculations can be made other than the general one,—that an acre will produce from forty to four hundred pounds of silk, at a cost not exceeding one dollar and fifty cents per pound, ready for market. The quantity must be deter-

mined by the circumstances above named ; the value of the silk is from four to seven dollars.

Each cultivator may make a calculation to suit his own climate and soil, by taking in round numbers one hundred pounds of leaves for one pound of reeled silk. Forty thousand worms, well fed, will give fifteen pounds of silk. An acre of trees or stools, in some situations, will yield at four years of age, fifty thousand pounds of leaves—which, at one hundred pounds per pound of silk, will be five hundred pounds ; but we will leave ten thousand pounds of leaves for wastage, &c. and then the quantity will be large. The leaves must be of the best quality to give one

pound of silk to one hundred pounds of leaves. It would require much more of watery leaves.

The business is new in this country—in some parts at least, and I would recommend that all should try experiments, which can be done without expense. The experience of one part of the country may be no guide for another part, yet we can compare notes; and, as this is a wide field for enterprise, where competition need not be feared, I hope that a liberal spirit will pervade all classes throughout the country, and all persons freely communicate such intelligence as may be useful.

I have not even mentioned manufactures of silk, as it has no connex-

ion with the business of the farmer. I will leave that subject to be considered hereafter, when we shall have raised sufficient materials to keep them employed. Of this I am sure, manufactures will spring up all around us, when we turn out the *bales* of raw silk.

DO THUNDER STORMS AF-
FECT THE WORMS ?

THIS is a question often asked and I will venture to answer, that so far as my experience goes, they do not —although they are thought to do so by some cultivators in Europe. I have carefully observed them during repeated severe thunder storms, and have tried experiments which prove to my mind, that the ill effects which have been supposed to be caused by thunder, have arisen from *suffocation*.

It is natural for any one on the ap-

proach of a thunder cloud, to fly to the windows—like sailors in a squall—to make all snug before the shower comes ; and as all thunder storms are preceded by hot sultry weather, it follows that the worms, having had a free circulation of air during the day, are suddenly shut up close in the sultry air of the cocoonry while the outward air is becoming purified by the storm. Worms nearly or quite ready to mount, will perish under such treatment.

I have tried a part of the same litter of worms, shut up under the circumstances as above, and the other part with the doors and windows all shut as before,—but with the *ventilators in the floor and roof open*. Those

in the close room nearly all perished before morning—(the storm was at 6, P. M.)—while those in the ventilated part were not affected in the least. You will therefore look well to the ventilators.

TO LANDHOLDERS.



To landholders throughout the United States, I would particularly address this chapter, and urge them by all means to plant mulberry trees. Your land will increase in value with the increasing growth of the trees.

Many large tracts of light uplands may be made, in a few years, more productive to the proprietor than the richest meadows. I have in another place mentioned the means by which they may be brought into a luxuriant growth of the mulberry.

Have you many poor families in your neighborhood to whom you would be benefactors and friends? Plant mulberry trees—provide silk worm eggs, and let each family have a part to raise at home—furnish them with leaves—take a portion of the produce as your share, leaving them an abundance for their support and yourself one hundred per cent on the investment in dollars and cents, and one thousand per cent in the satisfaction of having contributed to the comfort and happiness of your poor neighbors.

You enable the farmer of small means to keep his children at home, away from the factories—attending school—cultivating their immortal

minds, yet assisting in the cultivation of the richest of all the products of the soil—providing the comforts, if not the luxuries of life, and you thus remove many temptations from the path of the indigent. Many a lad in any part of the country would rejoice at the prospect thus held out to him of *educating himself* at our best colleges, by a few weeks industry in each season, aided by those who have now lands lying waste.

This is no idle speculation. Try it even in a small way till you are satisfied. If you set about it in earnest, you will be satisfied that you are enriching yourself, your neighbors, and your country.

TO THE OVERSEERS OF THE
POOR IN TOWNS AND CIT-
IES.

I WOULD ask you gentlemen, if the poor-houses under your charge are not felt to be odious public burdens? Are there not in all these poor-houses many, who by adverse fortune have been driven, as a last resort, to place themselves under your care, but who are still possessed of the finer feelings of our nature, to whom this feeling of some of your *boards* (to this character of overseers there are

many honorable exceptions) is like gall and wormwood ?

I think I can answer for some of you, that such is the case. Would you relieve your towns from these burdens ? Plant mulberry trees on the farms that are connected with many, and may be with all. The gathering of trees and feeding worms will be but pastime for the children and aged persons, on whose hands time now hangs heavy.

There are but few in our poor-houses who are not able to perform the light work of raising silk, and but few who would not prefer it, rather than idleness. And I will venture the assertion, that there are but few, if any towns, that may not

thus enable the poor to *support themselves* and enjoy the satisfaction at least of knowing, that they are not entirely objects of charity, but rather earning their own living under the direction of those who are more capable of guiding the helm than themselves. Thousands might be kept from the poor-house, had they kind friends but to advise and direct them, in cases, where, want of judgment and tact is the principal obstacle to their advancement in the world. *Do*, gentlemen, try the experiment. I am sure your towns can lose nothing by it. If they do not more than support their poor, it will be for want of interest and attention on your part. In the first

place, plant a few acres of mulberry trees. Your housekeepers can direct all the management of the worms, and there are always some in the house who can reel the cocoons;—if not, sell them; and if you will not raise the worms, raise the leaves and sell them. I am perfectly willing you should have it your own way, so that you *plant mulberry trees.*

STATE BOUNTIES.

WE are often asked, "if the silk business is so profitable, why do you ask for state bounties?" I would answer, that it is the great body of farmers whom we would engage in this business.

Farmers in all countries are slow to adopt improvements, and are particularly averse to any cultivation, that will not yield an immediate return. The very nature of the silk culture, requires *time* for the growth of the trees, and although our American system reduces the time former-

ly required to bring a plantation into profitable use, still we must have a year or two for the trees to become established. Besides, no one can expect to raise five or ten pounds of silk, at the same rate that he can raise fifty or five hundred.

A state bounty of twenty cents per pound *on cocoons* and fifty cents per pound for reeled silk, continued for a few years, will induce our farmers to engage extensively in the culture, and when it is once fairly established, I have no fears for the result. The state may then venture to leave the silk culture to rise on its own merits.

In all countries the culture of silk has engaged the particular attention

of governments and every encouragement has been given to increase its culture—and with success. In Germany it was undertaken to do it by compulsion. Laws were enacted compelling every owner and occupier of land to plant mulberry trees and feed silk worms. The result might have been anticipated. The people would not be *compelled* to do it, and sought every opportunity of destroying the trees.

I would compel *our farmers* to cultivate silk in quite another way. Induce one enterprising individual to clear five hundred dollars from an acre of ground, and the business is done for that neighborhood. If the enterprising farmer engages in ear-

nest, the five hundred, or a thousand dollars, per acre, will follow. Now they cannot *know* this till they try it, and will our legislatures induce them to try it?



MANUFACTURE OF SILK.

I HAD intended to omit the subject of the manufacture of silk, but as our ability to manufacture silk in this country is doubted by many, and the question is so often repeated in the numerous letters of inquiry which I receive, "Can we manufacture silk in this country in competition with China and Europe?" that I am induced here to say, that in some articles, we can, but that we must yield the palm to the French on the score of taste in design in the fancy trade.

They certainly excel in that. But in the plain staple articles of silk manufacture, we can compete with Europe and in some articles even with China ; but not from imported silk.

I have given my views in another chapter of the superior quality of American silk, and I hazard nothing in saying that when we are sufficiently established in the production of raw silk to insure a constant supply, manufactories will arise in every part of the country. There are already many in operation, which depend almost entirely on foreign silk. My own manufactory may be named as one, for which there is not yet silk enough raised in the coun-

try. We have power looms for ribbons, including those now in operation and those in the hands of the machinist, sufficient to turn off 4,000 yards of ribbon daily, of widths varying from half an inch wide to four inches,—besides machinery for sewing silk and braids. Another factory in the same town will require from two hundred to six hundred pounds per week, which must at present be imported.

The day will soon come when we can produce our *Sinchews* and *Pongees* in competition with China. You will ask, “How can this be?” How was it with cotton? Have not some of my readers samples of the “India cotton” as it was formerly

imported? Is not the scale completely turned now? There is scarcely a ship that does not take a part of her cargo in “Domestics” for Canton, and even *printed silk handkerchiefs*, from their own silk. The weaving of a piece of Sinchew, costs in Canton two dollars. It may be done by power looms in this country for fifty cents, from *American silk*, of course; we cannot do it from imported.

In any article of silk manufacture to which we can apply machinery, we can *now* even compete with Europe,—duty free. But when our own *raw material* is abundant, we shall be perfectly independent. We shall possess advantages which the

cotton and woollen manufacture does not. Why? Cotton and wool must be prepared by expensive machinery and by an expensive process, before it can be spun. The *silk worm* does all this, and it does it in better style in this country than in China or Europe. A vast deal of the labor which is there required, may be dispensed with here.

It is not my intention to enter into the details of manufacturing. I am very certain that it will keep pace with the production of the raw material.

I might amuse my readers, perhaps, with the calculation of the number of pieces of Sinchews and Pongees an acre will produce, in-

stead of pounds of silk ; but I will omit it for the present, and in connection with this subject will make some extracts from a work recently published in England by Doct. Ure,* shewing the extent and importance of the silk manufacture of England and France, in which a particular account of the schools of Design is given. Both of these topics I think are intimately connected with my subject and will prove interesting to my readers.

“The average produce of silk in Italy for the years 1829, 1830 and 1831, was from 5,000,000 to 6,000,-

* Philosophy of Manufactures, by Doct. Ure ; London ed.

000 of English pounds ; of which the Tyrol, Friuli and Lombardy, furnished 3,000,000 pounds ; the Roman States, Naples and Sicily, 600,000 pounds ; and Piedmont, 1,250,000, and this quantity is very capable of increase. From the Lombardy States, the export in 1831, was 335,000 pounds to Berlin and Vienna ; 120,000 to Russia ; 200,000 to Switzerland ; to the Rhenish manufactories, 500,000 pounds ; to England, 2,250,000 ; making altogether, 3,405,000 pounds, exported.

“ France employs about 700,000 pounds, or three fifths of the organzine silk thrown in Piedmont ; and England, the remaining two fifths, very nearly.

“ The duty on foreign raw silk in France is about 8*d.* the English pound ; except on India silk, which is only 2½*d.* per pound. The prices of the best French silks are generally ten per cent higher than those of similar Italian silks. In Zurich, where thrown silk is duty free, there were only 1000 looms in 1792, and there are 12,000 at present.

“ The silk trade of Great Britain at present may be valued at £7,000,000 sterling ; the silk importations from France through our custom-house amount to £450,000, and by smuggling to £300,000 more. The ribbon manufacture of England amounts to £1,000,000 annually ; and that of France to £1,300,000.

“The value of 4,200,000 pounds weight of raw silk manufactured in France, has been estimated at £5,600,000 sterling; of which goods equal to £5,400,000 are exported and only £1,200,000 worth retained for internal use; being probably not more than one fifth of the home consumption of the United Kingdom. The declared value of all our exported manufactured silks last year, was only £636,419; if this sum be deducted from our total manufacture, £7,000,000, the remainder £6,363,581 will denote the value of the silk goods retained for use,—a value which may, in round numbers, be rated at six millions sterling.

“Thus it would appear that the

females of this country can afford to spend five times more money upon the luxury of dress than those of France, who are one half more numerous and not less vain.

“The great developement of the silk manufacture in France is mainly owing to its being the least protected interest in the kingdom. Its spontaneous growth, being fostered by the natural taste of the people, has given it a stability at home and a steady demand over the whole world. As foreign silks are admitted at a moderate duty they stimulate to fresh improvement and suggest endless variations of style.

“The opinion generally entertained of the superiority of French figu-

red silks, and which may depend for their beauty on tasteful arrangement, is no more a prejudice of mankind, than the feeling in favor of the works of Raphael and Titian.

“In the manufacturing texture the prepossession however is in favor of Great Britain on account of superior machinery. Taste descends to the lowest classes of the community in France, in remarkable contrast with the neglect of it among the lower orders of our countrymen (England.) Taste is in fact a cheap commodity across the channel, it is rare and costly on this side of it; a circumstance due very much to the pains taken by the French government for a century and a half to encourage

the fine arts and to exhibit specimens of them freely to the people, in public buildings, all over the kingdom.

“Gratuitous schools of design also are established at Paris, Lyons, and many of the principal towns. Taste is displayed both in the forms and grouping of the figures and the disposition of the colors.

“The history of the introduction of the Jacquard loom, is a most instructive lesson on the advantage of free intercourse and rivalry between different countries. The inventor of that beautiful mechanism was originally an obscure straw-hat manufacturer who had never turned his mind to automatic mechanics, till

he had an opportunity by the Peace of Amiens, of seeing in an English newspaper the offer of a reward by our Society of Arts, to any man who would weave a net by machinery. He forthwith roused his dormant faculties and produced a net by mechanism ; but not finding the means of encouragement in the state of his country, he threw it aside for some time and eventually gave it to a friend as a matter of little moment. The net however got by some means into the hands of the public authorities and was sent to Paris.

“After a considerable period, when Jacquard had ceased to think of his invention, the Prefect of the Department sent for him and said,

“You have directed your attention to the making of net by machinery.” He did not immediately recollect it, but the net being produced recalled every thing to his mind.

“On being desired by the Prefect, to make the machine which had led to the result, Jacquard asked three weeks time for the purpose. He then returned with it and requested the Prefect to strike with his foot on a part of the machine, whereby a mesh was added to the net.

“On its being sent to Paris, an order was issued for the arrest of its constructor by Napoleon, in his usual sudden and arbitrary way. He was placed immediately in charge

of a *gendarme*, and was not allowed to go to his house to provide himself with necessaries for his journey. Arrived at the metropolis he was placed in the *Conservatorie des Arts*, and required to make the machine then in presence of inspectors; an order with which he accordingly complied.

“On his being presented to Bonaparte and Carnot, the former addressed him with an air of incredulity in the following terms—“Are you the man who pretend to tie a knot in a stretched string?” He then produced the machine and exhibited its mode of operation.

“He was afterwards called upon to examine a loom, on which 30,000

francs had been expended, for making fabrics for Bonaparte's use. He undertook to do by simple mechanism, what had been attempted in vain by a very complicated one; and taking for his model a machine of Vaucanson, he produced the famous Jacquard loom.

“He returned to his native town, rewarded with a pension of 1,000 crowns; but experienced the utmost difficulty to introduce his machine among the silk weavers; and was three times exposed to imminent danger of assassination. The *Conseil des Prudhommes*, who are the *official* conservators of the trade of Lyons, broke up his loom in the public place, sold the iron and wood for old

materials, and denounced him as an object of universal hatred and ignominy. Nor was it till the French people were beginning to feel the force of *foreign competition*, that they had recourse to this admirable aid of their countryman; since which time they have found it to be the only real protection and prop of their trade.*

“It is in the production of the patterns of silk goods that the French

* It may not be generally known that the Jacquard loom is the machine by which all figured goods are now made. It is really a wonderful machine, by which a novice in the art of weaving may execute the most beautiful patterns when once mounted. The pattern is cut

have a decided advantage over the British ;—they have probably little or none after the design is put into the loom.

“ The modes in which taste is cultivated at Lyons deserve particular study and imitation in this country. Among the weavers of the place, the children and every body connected with devising patterns, much attention is devoted to every thing in any way connected with the *beautiful*

on cards which are overhead and so arranged by cords that by moving the treadle the pattern proceeds. This machine has caused a great revolution in the fancy silk trade. It is also applied to all kinds of figured goods, silk, cotton, woolen and linen.

W.

either in figure or color. Weavers may be seen in their holiday leisure gathering flowers and grouping them in the most engaging combinations.* They are continually suggesting new designs to their employers; and are thus the fruitful source of elegant patterns. There is hardly any considerable house in Lyons, in which

* It is certainly much to be regretted, that so little taste for flowers and all that is beautiful in nature, is manifested by the majority of our farmers, and consequently of their children. Who but they should cultivate a taste for these things? Are they not in the midst of them? Were they made only to be trodden under foot and despised? I trust not. And if our farmers generally would take a little pains to cultivate the tasteful ornaments of the earth, as well

there is not a partner who owes his place in it to his success as an artist.

“The town of Lyons is so conscious of the value of such studies that it contributes 20,000 francs per annum, to the government establishment of the School of Arts, which takes charge of every youth who shows an aptitude for drawing or imitative design of any kind applicable to manufactures. Hence all the em-

as its substantial productions, there would be nothing lost, but much gained. It would lead to refinement of mind and manners, and should not the farmer be refined? Is there any thing in the employment and life of a farmer to prevent the cultivation of a taste for the “sublime and beautiful?”

W.

inent painters, sculptors, even botanists and florists of Lyons become eventually associated with the staple trade, and devote to it their happiest conceptions.

“In the principal school, that of St. Peters, there are about one hundred and eighty students; every one of whom receives from the town a gratuitous education in art for five years; comprehending delineations in anatomy, botany, architecture and loom pattern drawing.

“A botanical garden is attached to the school. The government allows 3100 francs a year to the school of Lyons. The school supplies the scholars with every thing but the materials and allows them to reap

the benefit of their works. The professor of painting is a man of distinguished talent, well known to connoisseurs.

“The French manufacturer justly considers that his pattern is the principal element of his success in trade ; for the mere handiwork of weaving is a simple affair with the improved Jacquard loom. He therefore visits the school and picks out the boy who promises by taste and invention to suit his purposes best. He invites him to his house and gives him a small salary to be gradually advanced.

“After three or four years, if the young artist’s success be remarkable he may have his salary raised, and

when his reputation is once established, he is sure of the offer of a partnership. Such is the general history of many of the school boys of Lyons.

“Even the French weaver, who earns 15*d.* or 20*d.* a day, prides himself upon his knowledge of design ; he will turn over several hundred patterns in his possession and discourse on their relative merits, seldom erring far in predicting the success of any new style. By this disposition the minds of the silk weavers in France become elevated and refined, instead of being stultified in *gin shops*, as those of the English too frequently are.

“In flower patterns the French

designs are remarkably free from incongruities, being copied from nature with scientific precision. They supply taste to the whole world in proportion to the extent of their exportations, which amount to one hundred and ten millions, out of one hundred and forty.

“In the Lyons school, collections of silk fabrics may be studied extending over a period of *four thousand years*, with explanations of the modes in which every pattern was produced, from the rude silk of the *Egyptian mummies* to figured webs of the last year.

“There are also weaving schools, containing from sixty to eighty scholars. In these a pattern being

exhibited, they are required to exercise their invention immediately as to the best means of producing the design on a piece of silk goods. The master removes such difficulties as are occasionally encountered, and leads them on to a successful accomplishment of the task.

“ Within a few years, a large legacy has been left by Gen. Martin for the purpose of establishing another institution similar to the school of St. Peters.

“ Their superiority in art is turned to good account in many other French manufactures, notwithstanding the double price of the raw material in France. Their fancy arti-

cles in iron and steel are exported in large quantities. Their bronze figures have made their way into all parts of the world, along side of their silk goods ; both being equally productions of fine taste and therefore yielding profitable returns.

“ The establishment at Lyons, which takes charge of the interests of its trade, and is called the “ *Conseil des Prudhommes*,” noticed above, is of a very useful nature.

“ When a manufacturer has invented a new pattern, he deposits a specimen of it, sealed, in the archives of that body, on which he pays from two to ten francs, according to the desired duration of his copy-right.

The Conseil can seize all pirated imitation goods, fine the offender, and even imprison him for ten days.

“ There is found to be practically very little difficulty in a man’s vindicating his patent right before this equitable tribunal which is one of the most popular and best organized institutions of France.

“ It originated in a decree of Bonaparte in 1806 for the reconstruction, throughout the kingdom, of the old manufacturing tribunals called the “ *Maitre gardes*.” It is composed at Lyons of nine master manufacturers and eight weavers, one of the former being President ; each party being elected by the general votes of its own body respectively ;

every weaver who possesses four looms being entitled to vote.

“This court decides all questions connected with the manufacturing interests of its particular district. Their proceedings are distinguished for temperance and sagacity. The men who represent the operatives, display sound sense and join in the discussions of the open court with equal propriety as their employers. All questions between masters and men—between men and apprentices, and in fact all which bear in any degree on the silk trade, are referred to the Conseil des Prudhommes. Their disposition seems always to be conciliatory. They examine parties, summon

witnesses with the power of compelling their attendance, and give awards from which there is no appeal, in reference to any sum less than one hundred francs. The number of appeals from this tribunal are very few."

FACTS FROM DANDOLO.

I SHALL also make a few extracts from a work of the *Count Dandolo*, both because the facts are curious, and to show the importance of attending to a thorough ventilation of rooms where silk worms are fed.

First, on the “quantity of gas and excremental substance emitted by the silk worm.”

“I here offer the calculation, resulting from facts, by which I have been able to ascertain the quantity of substance which issues from the

silk worm towards the close of the fifth age—that the calculation may show the evils which are constantly likely to attack a laboratory (or coconry.)

“It must be well observed, that I only allude to the noxious emanations exhaled by the silk worms, and not of the leaves, fibrous fragments, and excrements, all which substances deteriorate the air, and are injurious to the silk worms if not removed.

“The result of my experiment proves that 360 worms, which produce about one pound and a half of cocoons, weigh, when at their highest growth and size, three pounds, three ounces and a half.

“The silk worms, after this, are ready to begin their cocoons, in the course of two or three days, and then only weigh about two pounds, seven ounces.

“When the silk worms begin to rise, they void a quantity of nearly pure water, part of which is sometimes discharged through the silk-drawing tubes and by transpiration. They also evacuate a small quantity of solid substance, and then form the cocoon in three or four days.

“These cocoons altogether weigh about one pound and a half. Five ounces of eggs will produce six quintals of cocoons.

“If 360 worms weigh three pounds, three ounces and a half,

when in their utmost growth, it most clearly appears that the whole number which produce 600 pounds of cocoons, will weigh 1285 pounds, three ounces, when they reach their utmost growth.

“And if the worms previous to beginning their cocoons, only weigh 42 ounces, it must appear equally clear, that the whole number will weigh 10 quintals and 50 pounds; and therefore in three days, they must have lost $237\frac{1}{2}$ pounds weight of substance, either solid or liquid, from exhalation or steam. And if after two or three days, they are changed into 600 pounds of cocoons, it is evident, that in three or four days, they must have lost 450

pounds weight of substance either in liquid or in vapor and gas.

“In the space of six or seven days therefore, the bodies of the insects requisite to produce only 600 pounds cocoons must have lost 700 pounds weight of vapor or gas, solid and liquid excremental substance; this astonishing quantity of substance excreted from the bodies of the silk worms in so short a time, is of greater weight than the whole of the cocoons and aurelias, which only weigh 600 pounds. It is scarcely credible that they should yield so much noxious matter in a few days, were it not demonstrated by positive facts. It is needless to add that ventilation

will prevent the ill effects of so great a quantity of moisture.

“No branch of information however minute, can be useless when it can in any degree contribute to improvement, when it diminishes losses and when it increases the profits of any art whatever; and as my object is to enable any body to rear silk worms and to draw from them every possible advantage they can offer, I have even tried to ascertain the exact loss of weight of the cocoon each day.

“I carefully weighed every day 1000 ounces of cocoons, reckoning from the moment they completed their formation until I perceived

that some moths wet the cocoon a little and were preparing to come forth.

“The following is the result of the daily decrease of 1000 ounces of cocoons in a temperature of 71 degrees and 73 degrees.

Gathered from the fagots and cleaned, the cocoons weighed 1000 ounces.

First day following,	991	“
Second	“	982 “
Third	“	975 “
Fourth	“	970 “
Fifth	“	966 “
Sixth	“	960 “
Seventh	“	952 “
Eighth	“	943 “
Ninth	“	934 “
Tenth	“	925 “

“We find by this that the cocoons lose in ten days seven and a half per cent, by the desiccation of the chrysalis alone. The first four days they lose three per cent, or three quarters per cent a day ; in the last days they lose rather more, because as the formation of the moth approaches, a greater quantity of humidity evaporates.”

“Facts relative to the increase and decrease of silk worms in weight and size.

Progressive increase.

One hundred worms just hatched weigh 1 grain.

After the first moulting	15 grains.
“ Second “	94 “
“ Third “	400 “
“ Fourth “	1628 “
On attaining the greatest size	9500 “

“Thus have they in thirty days increased 9500 times their primitive weight.

“The worm diminishes gradually in weight during the last twenty-eight days of its existence ;—that is, from the moment of attaining its perfection as a worm, until its death in the form of a moth. It eats nothing, is supported by its own substance, and yet accomplishes in that period

the most important functions of its life.

“The facts I have stated demonstrate the strong vitality of the silk worm and what pains and errors must be adapted to disease and kill it.”

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